day 53

4.1/57

- crit pts
- abs extrema
- graph it

$f(x) = 2^x \sin(x)$; $[-2, 6]$

① $f'(x) = \frac{d}{dx}(2^x)\cdot\sin x + 2^x \cdot \frac{d}{dx}(\sin x)$

$= 2^x \cdot \ln 2 \cdot \sin x + 2^x(\cos x)$

✓ $= 2^x\left((\ln 2)\sin x + \cos x\right)$

② $f'(x) = 0$

$2^x\left((\ln 2)\sin x + \cos x\right) = 0$

$0 = 2^x$ ✗

$(\ln 2)\sin x + \cos x = 0$

$-\cos x \quad -\cos x$

$\ln 2 \sin x = -\cos x$

$\frac{\ln 2 \sin x}{\cos x} = \frac{-\cos x}{\cos x}$

$\ln 2 \tan x = -1$

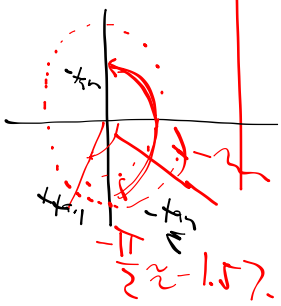
$\tan x = \frac{-1}{\ln 2}$ so $x = \tan^{-1}\left(\frac{-1}{\ln 2}\right)$

$x = \arctan\left(\frac{-1}{\ln 2}\right)$

crit 2 (or prob 3 from $f'(x)=0$)

none for $f'(x)$ undef.

$\frac{2 \cdot 3 \cdot 4}{2} = \frac{24}{2} = 12$



crit numbers

$\arctan\left(\frac{-1}{\ln 2}\right) + n\pi$, $\arctan\left(\frac{-1}{\ln 2}\right) + \pi$, $\arctan\left(\frac{-1}{\ln 2}\right) + 2\pi$

$\approx$ $\approx$ $\approx$

Let $T = \arctan\left(\frac{-1}{\ln(2)}\right)$

③ find absolute extrema

candidate 1: $2^{(-2)}\sin(-2) =$ $-.227$

2: $2^{\arctan\left(\frac{-1}{\ln 2}\right)} \sin\left(\arctan\left(\frac{-1}{\ln 2}\right)\right)$ $-.421$

3: $2^{\arctan\left(\frac{-1}{\ln 2}\right)+\pi} \sin\left(\arctan\left(\frac{-1}{\ln 2}\right)+\pi\right)$ 3.716

4: $2^{\text{"}+2\pi} \sin(\text{"}+2\pi)$ -32.796

5: $2^6 \sin(6)$ -17.882

Nov 14-7:24 AM

Concavity

day 53

Def^n A function, $f(x)$, is concave (down) up on an interval if $f'(x)$ is (decreasing) increasing on the interval.

Def^n: A function $f(x)$ is (decreasing) increasing (<) on an interval if $f(x_2) > f(x_1)$ whenever $x_2 > x_1$

day 53

Increasing

A continuous & differentiable function $f(x)$

is increasing on an interval

if $f'(x) > 0$ on that interval

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day 53

$f(x)$	increasing	$f'(x) > 0$
	decreasing	$f'(x) < 0$
	maximum	$f'(x) = 0$ or dne
	minimum	$f'(x) = 0$ "
$f'(x)$	positive	$f(x)$ increasing
	negative	$f(x)$ decreasing
	increasing	$f(x)$ is concave up
	decreasing	$f(x)$ is concave down
$f''(x)$	positive	$f'(x)$ increasing
	"	$f(x)$ concave up
	negative	$f'(x)$ decreasing
	"	$f(x)$ concave down

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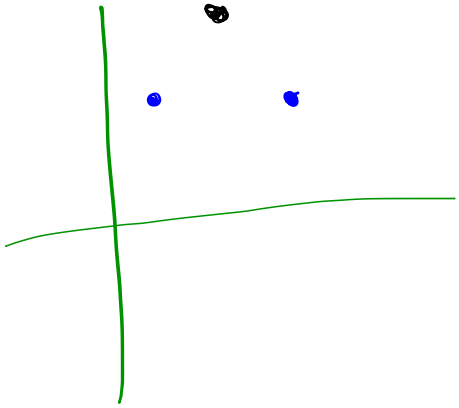
day 53

4.1/55 b) If a function has an absolute maximum, then the function must be continuous on a closed interval

absolute maximum
continuous
closed [interval]
function
if
then
must



day 53

4.1/55d) IF Absolute extreme values on a closed interval always occur at a critical point or an endpoint of the interval

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